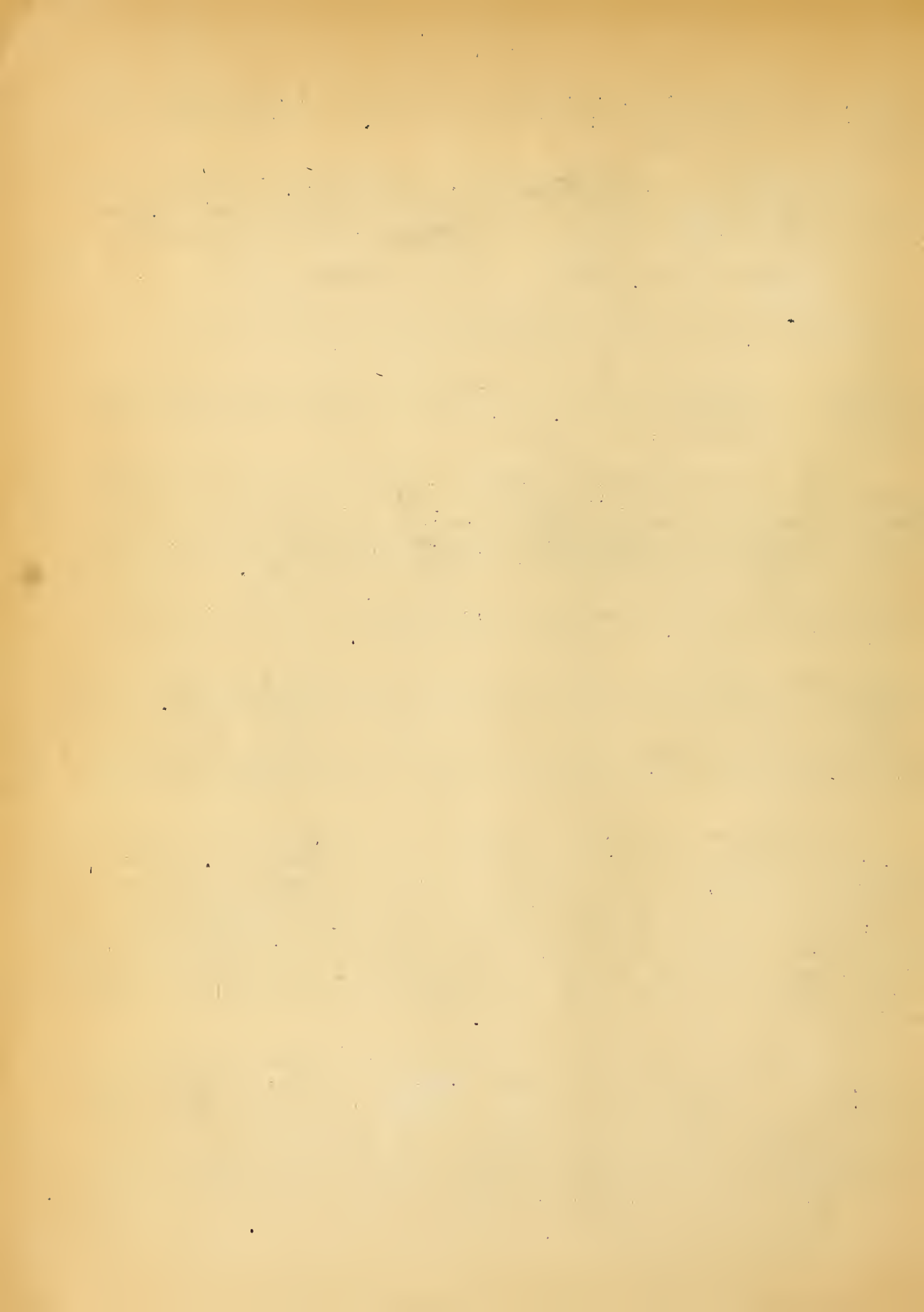


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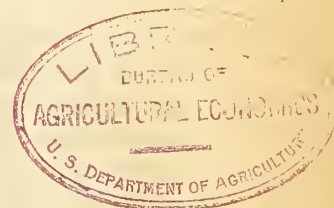
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UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics
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RUBBER-TIRED EQUIPMENT OF PRINCIPAL FARM MACHINES

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SOURCE OF MATERIAL

Crop correspondents in February 1941 supplied information relative to the age, type, rubber tired equipment, fuel consumed, and work performed by their tractors. They estimated the number of tractors of different type on farms in their locality, the extent of use of rubber tires on general-purpose and standard-wheel tractors; the percentage of farmers owning combines, grain binders, mowers and manure spreaders; and the proportion of these machines that were equipped with rubber tires. Usable returns were received from more than 25,000 crop correspondents who reported on machines for their locality and on more than 17,000 tractors on their own farms. The reports provided complete information as to age and type of tractor and extent of use of rubber tires for more than 13,000 tractors.

This report summarizes the information collected on the use of rubber tires on tractors and some other farm machines. Other findings of the study are summarized in the reports "Farm Tractors, Type-Size, Age and Life" and "Fuel Consumed and Work Performed by Farm Tractors".

The material was analyzed in the Bureau of Agricultural Economics, David O. Thomas, L. G. Shestock, Caroline G. Towles, Edith E. Snow, Cora L. Whitmer, Dorothy B. Owen, and other members of the staff assisted in the computations.

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A survey of rubber tires on farm machines was made in February 1941. At that time, as during the past decade or more, crude rubber supplies in the United States were plentiful and prices of tires and other rubber products were low. With the beginning of war in the Pacific, rubber tires have suddenly become of tremendous concern. The reason for this concern is that more than 90 percent of our crude rubber supplies have been coming from the Far East, with British Malaya, the Netherlands Indies, and Ceylon, the chief sources of these supplies. In the immediate future the present war makes it highly uncertain whether much rubber can be obtained from these sources and appreciable quantities of substitutes are not in prospect. Thus it seems certain that for some time rubber use will be restricted to purposes concerned directly with the war effort.

FARM USE OF RUBBER

For a considerable number of years farmers have been using rubber tires on implements and machines which were adapted for field work. At first the most extensive use of rubber tires was on wagons and trailers which were mainly constructed from parts of discarded automobiles and trucks. Old automobile tires were commonly used for these purposes. However, industrial tractors have long been equipped with high pressure pneumatic or solid rubber tires, but they did not generally provide adequate traction under field conditions.

In the early 1930's tire manufacturers developed a low-pressure tire specially adapted for tractor use under farm conditions. Owing to the low purchasing power of farmers, sales of tractors in 1932 and 1933 were at

an exceptionally low level, but even in the depression period sales of tractors equipped with rubber tires increased relative to the sale of other tractors, and around 14 percent of the wheel tractors sold in 1935 had rubber tires. In 1940 and 1941 about 95 percent of these tractors had rubber tires (table 1).

Table 1. - Estimated percentage of designated machines sold in the United States equipped with rubber tires in specified years

Kind of machine	: Percentage of domestic sales equipped with rubber tires			
	: 1937	: 1938	: 1939	: 1940
	: <u>Percent</u>	: <u>Percent</u>	: <u>Percent</u>	: <u>Percent</u>
Wheel tractors, all types	: 43	: 68	: 84	: 95
General-purpose tractors	: 43	: 69	: 86	: 96
Standard-wheel tractors	: 40	: 57	: 71	: 80

Source: Compiled from reports of the Census of Manufacturers, United States Department of Commerce.

If there were no restrictions in the manufacture of farm machines and in the farm use of rubber in 1942, at least 12,000 long tons of rubber would have been used in the production of new farm machines in that year. This does not include any allowance for rubber for manufacturing and equipping new farm automobiles and farm motor trucks in 1942. Rubber replacement needs for farm motor vehicles and farm machines would likely exceed 50,000 long tons in 1942 under conditions of normal rubber supply. With war restrictions on the manufacture of farm machines and motor vehicles and on the use of crude rubber, farm utilization of crude rubber in 1942 will be reduced greatly.

MOST GENERAL PURPOSE TRACTORS HAVE RUBBER TIRES

More than 75 percent of all the general-purpose tractors on farms January 1, 1941 were partially or completely equipped with rubber tires, whereas only about one-third of the standard-wheel tractors were so

equipped (table 2). The high use of rubber tires on general-purpose tractors is accounted for by the fact that the bulk of the general-purpose tractors ~~are newer and~~ have been produced since rubber became popular on farm equipment. Even for comparable age groups, use of rubber tires is more common for general-purpose tractors than for standard-wheel tractors (table 3). Many older tractors have been converted from steel to rubber tires. For example, only 10 percent of the tractors sold from 1931 to 1935 had rubber tires. Yet, on January 1, 1941, of the tractors in this age group still on farms many had rubber tires. More than 45 percent of the general-purpose tractors and over 30 percent of the standard-wheel tractors in this 5-9 year age group were completely equipped with rubber tires. Many more were partially equipped.

It is evidently much easier to equip the front wheels of tractors with rubber tires, because the smaller front wheel can use discarded auto and truck tires or can be given less expensive new tires than can the large rear wheels. For this reason, many more of the tractors in older age groups have rubber on the front only.

RUBBER TIRES ON COMBINES

Many combines are used for custom work and mounting them on rubber tires facilitates greatly the moving of combines from farm to farm especially when travel on paved highways is necessary. The use of rubber tires reduces vibration and permits higher speed of travel than could be realized with steel wheels. These are important aspects in combine operation. For the country as a whole it was estimated that 57 percent of the combines had rubber tires (table 4). The use of rubber tires on combines was relatively frequent in the Central and Eastern States where use of combines has been increasing most rapidly in recent years and where the small-sized combine generally predominates.

In the Great Plains and in the Western States older and larger combines are found and the use of rubber tires has been below the national average.

USE OF RUBBER TIRES ON OTHER MACHINES

Relatively few of the grain binders, mowing machines, and manure spreaders on farms were equipped with rubber tires. A tractor-mounted mower is now being sold and, even without the tire-rationing order, would likely restrict the demand for rubber-tired mowers. In 1940 about 12 percent of the manure spreaders sold were equipped with rubber tires. Such spreaders are adapted for tractor use and in normal times might well increase with further increase in use of tractors. Very few binders now on farms are equipped with rubber tires, probably because binder sales in recent "rubber" years have been small.

Table 2. - Rubber-tire equipment on farm wheel tractors, by type of tractor for State groups and the United States, January 1, 1941

State groups 1/	: Tractors : Percentage of tractors equipped with				
	: on farms : Rubber tires, : Rubber tires, : Rubber tires, : No				
	: Jan. 1, : front : front : rear : rubber				
	: 1941 : and rear : only : only : tires				
	(1,000)	Percent	Percent	Percent	Percent
<u>All Wheel Tractors</u>					
North Atlantic	157	54	6	1	39
Corn Belt	487	47	8	1	44
Lake States	265	51	8	1	40
Great Plains	269	43	9	2	46
South Atlantic	65	54	2	1	43
South Central	67	45	3	1	51
Oklahoma-Texas	151	66	4	1	29
Mountain	71	53	3	2	42
Pacific	50	52	2	1	45
United States	1,582	50	7	1	42
<u>General-Purpose</u>					
North Atlantic	83	75	9	2/	16
Corn Belt	344	59	10	2/	31
Lake States	147	71	11	1	17
Great Plains	127	57	15	1	27
South Atlantic	33	77	2	2/	21
South Central	44	63	4	2/	33
Oklahoma-Texas	104	79	5	2/	16
Mountain	31	82	4	1	13
Pacific	19	86	3	1	10
United States	932	67	9	1	23
<u>Standard-Wheel</u>					
North Atlantic	67	23	3	1	73
Corn Belt	139	20	5	1	74
Lake States	109	21	3	1	75
Great Plains	141	30	4	2	64
South Atlantic	29	24	2	2/	74
South Central	23	15	2	2/	83
Oklahoma-Texas	47	49	3	1	47
Mountain	38	30	2	3	65
Pacific	29	32	1	1	66
United States	622	27	4	1	68
<u>Homemade Tractors</u>					
United States	25	74	8	2	16
<u>Garden Tractors</u>					
United States	3	8	2/	2/	92

1/ North Atlantic States include Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, Corn Belt States include Ohio, Indiana, Illinois, Iowa and Missouri, Lake States include Michigan, Wisconsin, Minnesota. Great Plains States include North Dakota, South Dakota, Nebraska, and Kansas. South Atlantic States include Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida. South Central States include Kentucky, Tennessee, Alabama, Mississippi, Arkansas, and Louisiana.

2/ Less than one-half of 1 percent.

Table 3. - Rubber-tire equipment of wheel tractors on farms, by age groups, United States, January 1, 1941

Age of tractors on January 1, 1941	Tractors on farms Jan. 1, 1941	Percentage of tractors having			
		Rubber tires, front and rear	Rubber tires, front only	Rubber tires, rear only	No rubber tires
	Number (1,000)	Percent	Percent	Percent	Percent
<u>All wheel Tractors 1/</u>					
Less than 5 years	838	73	8	1	18
5 - 9 years	255	40	8	1	51
10 - 14 years	362	18	5	1	76
15 years and over	99	6	2	1	91
Total	1554	50	7	1	42
<u>General-Purpose</u>					
Less than 5 years	700	75	9	2/	16
5 - 9 years	147	46	11	1	42
10 - 14 years	30	35	11	1	53
15 years and over	5	19	19	2/	62
Total	932	67	9	1	23
<u>Standard-wheel</u>					
Less than 5 years	138	67	4	2	27
5 - 9 years	108	32	4	2	62
10 - 14 years	282	13	4	1	82
15 years and over	94	5	2	1	92
Total	622	27	4	1	68

1/ Includes only general-purpose and standard-wheel tractors which constitute more than 93 percent of all wheel tractors.

2/ Less than one-half of 1 percent.

Table 4. - Proportion of specified farm machines equipped with rubber tires by State groups, January 1, 1941

State group ^{1/}	Equipped with rubber tires			
	Grain	Combine	Mowing	Manure
	binders	harvester- thresher	machines	spreaders
	Percent	Percent	Percent	Percent
North Atlantic	2	85	3	4
Corn Belt	1	87	3	3
Lake States	1	89	2	3
Great Plains	3	39	2	1
South Atlantic	5	83	2	2
South Central	11	80	1	2
Oklahoma-Texas	12	56	4	2
Mountain	4	38	5	2
Pacific	5	33	7	2
United States	2	57	3	3

^{1/} See footnote 1, table 2.

The extensive use of rubber tires on tractors and combines as compared with most other farm machines is largely accounted for by the fact that these machines are relatively heavy and expensive, and that tires represent a smaller percentage of the total cost than is true for many smaller and less expensive farm machines. The need for moving tractors and combines on highways, especially where custom work is done, the ease of operation, and the relatively large number of days used per year, are other reasons for their greater tire use.

WHY RUBBER-TIRE USE HAS INCREASED

Studies that have been made concerning the use of rubber tires generally have direct application to tractors, but the results are also applicable to other farm machines. In general, these studies show that the use of rubber tires on farm machines adds greatly to the physical comfort of the operator, and facilitates the movement of machines over paved highways.

Rolling resistance is less with rubber tires than with steel wheels. Under most field conditions, this means that travel speed can be increased or the size of load increased. Thus, the fuel consumed for performing a specified amount of work is usually less for rubber-tired tractors than for

tractors with steel traction. Savings in fuel are especially significant for light-duty jobs like mowing hay, and usually of less significance for heavy work such as plowing and discing. All these advantages are important, of course, but in the years ahead it must be recognized that they are useless considerations if our fighting forces and more essential civilian uses leave no rubber for farm equipment.

On the side of disadvantages, the use of rubber adds to the original cost of machines. Prices of farm tractors equipped with rubber tires are often about 20 percent higher than are prices of the same machine with steel wheels. For other types of farm machines, the relative increase in initial cost is often greater than for tractors. Then, too, machines with steel wheels and lugs have better traction when the soil is wet, or the surface covered with ice or snow than do rubber-tired tractors.

Crop correspondents supplied information relative to the performance of rubber-tired and steel-wheeled tractors in 1940. Sufficient information was supplied to permit classifying tractors according to size. They supplied also estimates as to the average area plowed in a 10-hour day, the total fuel consumed, and the total time each tractor was used in 1940. Reports covering 2,946 general-purpose tractors show that for comparable age, fuel consumption per hour of use was about the same for rubber-tired as for steel-wheeled tractors. However, on an average the rubber-tired tractor plowed about 10 percent more land in a day than was plowed with steel tractors, and the total annual use was about 18 percent more for tractors on rubber than for tractors with steel wheels (table 5).

Table 5. - Performance of general-purpose tractors with rubber and with steel traction, United States, 1940

Tractor age group, Jan. 1, 1941	: : report- : ing :	: Wheel : traction: : of : tractor : 1/ :	: Average : size of : tractor :	: Average : area : plowed in: : 10-hr. : day :	: Average : time : used : in : 1940 :	: Fuel : consumed : per hour : of use :
	: <u>Number</u>		: <u>D.B.H.P.</u>	: <u>Acres</u>	: <u>Hours</u>	: <u>Gallons</u>
Less than 5 years	: 1,527	rubber	15.7	8.1	571	1.56
Less than 5 years	: 721	steel	15.0	7.5	504	1.54
5 - 9 years	: 186	rubber	16.3	8.7	662	1.63
5 - 9 years	: 270	steel	14.4	7.5	493	1.61
10 - 14 years	: 63	rubber	13.7	8.0	611	1.59
10 - 14 years	: 179	steel	12.8	7.3	449	1.69
All ages	: 1,776	rubber	15.7	8.1	582	1.57
All ages	: 1,170	steel	14.5	7.4	493	1.57

1/ Tractors with rubber traction had rubber tires front and rear. Tractors with steel traction include a few tractors that had rubber tires on front or rear wheels.

